

CLAIMS

1. A DC voltage corona discharging neutralization apparatus comprising
a neutralization apparatus main body;
a plurality of plus electrodes which are provided in the neutralization apparatus main body and to which plus voltage is applied to generate plus ions,
a plurality of minus electrodes which are provided in the neutralization apparatus main body and to which minus voltage is applied to generate minus ions, and
a plurality of gas injection ports which are formed in the neutralization apparatus main body and from which gas flow for transferring ions is injected, wherein
the gas injection ports are provided between the plus electrodes and the minus electrodes.
2. The neutralization apparatus according to claim 1, further comprising
a metal conductive plate which is made of metal and which is not grounded, wherein
the neutralization apparatus main body is made of insulative resin material, and the metal conductive plate covers outside of the neutralization apparatus main body.
3. The neutralization apparatus according to claim 1 or 2, further comprising
ion sensors which are disposed between the plus electrodes and the minus electrodes and which are provided in the neutralization apparatus main

body, and which detect an ion balance state and output detection signals, and
a central processing unit which adjusts plus voltage applied to the plus electrodes and/or minus voltage to be applied to the minus electrodes to control the ion balance based on the detection signals from the ion sensors, wherein

the central processing unit adjusts the plus voltage to be applied to the plus electrodes and/or minus voltage to be applied to the minus electrodes according to the detection signals, and adjusts the ion balance to zero balance.

4. The neutralization apparatus according to claim 3, further comprising a setting unit which is connected to the central processing unit, and which sets a positive mode in which more plus ions than minus ions are generated or only plus ions are generated to bring the ion balance into an unbalanced state, or sets a negative mode in which more minus ions than plus ions are generated or only minus ions are generated to bring the ion balance into an unbalanced state, instead of a normal mode in which the ion balance is adjusted to zero balance, wherein

the central processing unit intentionally adjusts the plus ions and minus ions into the unbalanced state according to the positive mode or the negative mode.

5. The neutralization apparatus according to any one of claims 1, 2, or 4, wherein

the plus electrodes and the minus electrodes are respectively provided with discharge needles which are inclined toward the gas injection ports,

the gas flow is injected from each of the gas injection ports in a

direction substantially perpendicular to the subject to be neutralized, and an extension of the discharge needle of the plus electrode and an extension of the discharge needle of the minus electrode intersect with each other on the gas flow.

6. The neutralization apparatus according to claim 3, wherein the plus electrodes and the minus electrodes are respectively provided with discharge needles which are inclined toward the gas injection ports, the gas flow is injected from each of the gas injection ports in a direction substantially perpendicular to the subject to be neutralized, and an extension of the discharge needle of the plus electrode and an extension of the discharge needle of the minus electrode intersect with each other on the gas flow.

7. The neutralization apparatus according to claim 5, wherein each of the ion sensors is of a rod-like shape, a straight shaft direction of the ion sensor is parallel to a gas injection direction, and the straight shaft of the ion sensor is mounted such that the extension of the discharge needle of the plus electrode and the extension of the discharge needle of the minus electrode intersect with each other.

8. The neutralization apparatus according to claim 6, wherein each of the ion sensors is of a rod-like shape, a straight shaft direction of the ion sensor is parallel to a gas injection direction, and the straight shaft of the ion sensor is mounted such that the extension of the discharge needle of the plus electrode and the extension of the discharge needle of the minus

electrode intersect with each other.

9. The neutralization apparatus according to claim 1 or 2, wherein both the plus electrode and minus electrode have the same mechanical structures,

each of the plus electrode and the minus electrode includes an electrode holder which is an electrical insulator and which is mechanically connected to the neutralization apparatus main body, a conductive portion disposed in the electrode holder, and two discharge needles which are electrically connected to the conductive portion, and wherein

the two discharge needles are inclined in a form of a π -shape.

10. The neutralization apparatus according to claim 1 or 2, wherein an end plus electrode and an end minus electrode disposed on ends have the same mechanical structures,

each of the end plus electrode and end minus electrode includes an electrode holder which is an electrical insulator and which is mechanically connected to the neutralization apparatus main body, a conductive portion disposed in the electrode holder, and one discharge needle which is electrically connected to the conductive portion, and wherein

the one discharge needle is inclined toward the gas injection port.